AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (canceled).

2. (canceled).

3. (canceled).

4. (original): A digital image texture analyzing method comprising the steps of:

(a) obtaining a mean (μ_0) and a variance (σ_0) of pixel values of an original image;

(b) obtaining m x n filtered images by filtering the original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers;

(c) calculating means (μ_{11} , μ_{21} , ..., μ_{mn}) and variances (σ_{11} , σ_{21} , ..., σ_{mn}) of the respective filtered images; and

(d) obtaining a texture descriptor having the mean (μ_0) and a variance (σ_0) of the pixel values of the original image obtained in the step (a), and the means (μ_{11} , μ_{21} , ..., μ_{mn}) and variances (σ_{11} , σ_{21} , ..., σ_{mn}) of the respective filtered images obtained in the step (c), as texture features.

5. (previously presented): The method according to claim 4, wherein the predetermined filters are Gabor filters.

6. (original): A computer-readable recording medium for storing program codes for performing a digital image texture analyzing method comprising the steps of:

(a) obtaining a mean (μ_0) and a variance (σ_0) of the pixel values of an original image;

(b) obtaining m x n filtered images by filtering the original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers;

(c) calculating means (μ_{11} , μ_{21} , ..., μ_{mn}) and variances (σ_{11} , σ_{21} , ..., σ_{mn}) of the respective filtered images; and

(d) obtaining a texture descriptor having the mean (μ_0) and a variance (σ_0) of the pixel values of the original image obtained in the step (a), and the means (μ_{11} , μ_{21} , ..., μ_{mn}) and variances (σ_{11} , σ_{21} , ..., σ_{mn}) of the respective filtered images, obtained in the step (c), as texture features.

7. (previously presented): The recording medium according to claim 6, wherein the predetermined filters are Gabor filters.

8. (canceled).

9. (currently amended): ~~The~~ <u>A digital image texture analyzing</u> apparatus ~~according to claim 8, further~~ comprising<u>:</u>

<u>a mean/variance calculating unit which calculates a mean and a variance of pixel values of an original image;</u>

<u>a texture descriptor setting unit which sets the mean and the variance as texture descriptors; and</u>

a filtering unit which filters the original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers, to obtain m x n filtered images,

wherein the mean/variance calculating unit obtains the mean (μ_0) and a variance (σ_0) of the pixel values of the original image and the means ($\mu_{11}0$, $\mu_{21}0$, ..., $\mu_{mn}0$) and variances ($\sigma_{11}0$, $\sigma_{21}0$, ..., $\sigma_{mn}0$) of the respective filtered images, and

wherein the texture descriptor setting unit obtains a texture descriptor having the mean (μ_0) and a variance (σ_0) of the pixel values of the original image, and the means (μ_{11} , μ_{21} , ..., μ_{mn}) and variances (σ_{11} , σ_{21} , ..., σ_{mn}) of the respective filtered images, as texture features.

10. (original): A digital image searching method comprising searching for an image having a similar texture descriptor to a query image using a texture descriptor having a mean and a variance of the pixel values of an original image as texture features.

11. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising calculating a matching metric including absolute differences between means of pixel values of the two arbitrary digital images.

12. (original): The method according to claim 11, wherein the matching metric further includes absolute differences between variances of the pixel values of the original image.

13. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising calculating a matching metric including absolute differences between variances of pixel values of the two arbitrary digital images.

14. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining m x n filtered images with respect to the two arbitrary images using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and

(b) calculating the matching metric defined by:

$$d(i,j)=\sum_{m,n} d_{m,n}(i,j)+b$$

with respect to an original image and the m x n filtered images, where a mean and a variance of pixel values of the respective filtered images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0 ,

$b=\left|\frac{\mu_0^{(i)}-\mu_0^{(j)}}{\alpha(\mu_0)}\right|+\left|\frac{\sigma_0^{(i)}-\sigma_0^{(j)}}{\alpha(\sigma_0)}\right|$, $d_{m,n}(i,j)=\left|\frac{\mu_{m,n}^{(i)}-\mu_{m,n}^{(j)} j}{\alpha(\mu_{m,n})}\right|+\left|\frac{\sigma_{m,n}^{(i)}-\sigma_{m,n}^{j}}{\alpha(\sigma_{m,n})}\right|$, and α( ) is a predetermined scaling function.

15. (previously presented): The method according to claim 14, wherein the predetermined filters are Gabor filters.

16. (original): A computer-readable recording medium for storing program codes for performing a digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining m x n filtered images with respect to the two arbitrary images using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and

(b) calculating the matching metric defined by:

$$d(i,j)=\sum_{m,n} d_{m,n}(i,j)+b$$

with respect to an original image and the m x n filtered images, where a mean and a variance of pixel values of the respective filtered images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0 ,

$b=\left|\frac{\mu_0^{(i)}-\mu_0^{(j)}}{\alpha(\mu_0)}\right|+\left|\frac{\sigma_0^{(i)}-\sigma_0^{(j)}}{\alpha(\sigma_0)}\right|$, $d_{m,n}(i,j)=\left|\frac{\mu_{m,n}^{(i)}-\mu_{m,n}^{(j)}j}{\alpha(\mu_{m,n})}\right|+\left|\frac{\sigma_{m,n}^{(i)}-\sigma_{m,n}^{j}}{\alpha(\sigma_{m,n})}\right|$, and $\alpha(\,)$ is a predetermined scaling function.

17. (previously presented): The recording medium according to claim 16, wherein the predetermined filters are Gabor filters.

18. (original): A digital image texture analyzing apparatus for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the apparatus comprising:

(a) a filtering unit which obtains m x n filtered images with respect to the two arbitrary images using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and

(b) a matching metric calculating unit which calculates the matching metric defined by:

$$d(i,j)=\sum_{m,n} d_{m,n}(i,j)+b$$

with respect to an original image and the m x n filtered images, where a mean and a variance of pixel values of the respective filtered images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0 ,

$b = \left| \frac{\mu_0^{(i)} - \mu_0^{(j)}}{\alpha(\mu_0)} \right| + \left| \frac{\sigma_0^{(i)} - \sigma_0^{(j)}}{\alpha(\sigma_0)} \right|$, $d_{m,n}(i,j) = \left| \frac{\mu_{m,n}^{(i)} - \mu_{m,n}^{(j)} j}{\alpha(\mu_{m,n})} \right| + \left| \frac{\sigma_{m,n}^{(i)} - \sigma_{m,n}^{j}}{\alpha(\sigma_{m,n})} \right|$, and α( ) is a predetermined scaling function.

19. (previously presented): The apparatus according to claim 18, wherein the predetermined filters are Gabor filters.

20. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining filtered images using predetermined filters having different orientation coefficients with respect to the two arbitrary images; and

(b) obtaining a matching metric by calculating a minimum value of a sum of absolute differences between means of pixel values with respect to an arbitrary filtered image and images filtered by filters having orientation coefficients different from those of filters used for filtering the arbitrary image.

21. (previously presented): The method according to claim 20, wherein the predetermined filters are Gabor filters.

22. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining filtered images using predetermined filters having different orientation coefficients with respect to the two arbitrary images; and

(b) obtaining a matching metric by calculating a minimum value of a sum of absolute differences between variances of pixel values with respect to an arbitrary filtered image and images filtered by filters having orientation coefficients different from those of filters used for filtering the arbitrary image.

23. (previously presented): The method according to claim 22, wherein the predetermined filters are Gabor filters.

24. (original): The method according to claim 22, wherein the step (b) includes the step of obtaining a matching metric by calculating the minimum value of an added value of the sums of absolute differences between the means and the variance of the pixel values with respect to the arbitrary filtered image and the images filtered by the filters having orientation coefficients different from those of the filters used for filtering the arbitrary image.

25. (original): The method according to claim 22, wherein the step (a) includes the step of (a') obtaining m x n filtered images with respect to the two arbitrary images by filtering an original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and wherein the step (b) includes the step of (b') calculating the matching metric defined by:

$$d_{m,n}(i,j) = \min_{l \le l \le K}\left[\sum_{m,n}\left(\left|\frac{\mu^{(i)}_{m,n}}{\alpha(\mu_{m,n})} - \frac{\mu^{(j)}_{m,n\oplus l}}{\alpha(\mu_{m,n})}\right|\right) + \left(\left|\frac{\sigma^{(i)}_{m,n}}{\alpha(\sigma_{m,n})} - \frac{\sigma^{(j)}_{m,n\oplus l}}{\alpha(\sigma_{m,n})}\right|\right)\right]$$

with respect to the m x n filtered images, where a mean and a variance of pixel values of the respective images are μ and σ, K is a predetermined positive integer representing a number of orientations to be considered, $\oplus$ denotes a modulo shift function, and $\alpha(\ )$ is a predetermined scaling function.

26. (original): The method according to claim 25, wherein the step of (b') calculating the matching metric further defined by:

$$d_{m,n}(i,j)=\min_{l\le t\le K}\left[\sum_{m,n}\left(\left|\frac{\mu_{m,n}^{(i)}}{\alpha(\mu_{m,n})}-\frac{\mu_{m,n\oplus t}^{(j)}}{\alpha(\mu_{m,n})}\right|\right)+\left(\left|\frac{\sigma_{m,n}^{(i)}}{\alpha(\sigma_{m,n})}-\frac{\sigma_{m,n\oplus t}^{(j)}}{\alpha(\sigma_{m,n})}\right|\right)\right]+b$$

with respect to the m x n filtered images, where the mean and the variance of the pixel values of the respective images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0, K is the predetermined positive integer representing the number of orientations to be considered, $b=\left|\frac{\mu_0^{(i)}-\mu_0^{(j)}}{\alpha(\mu_0)}\right|+\left|\frac{\sigma_0^{(i)}-\sigma_0^{(j)}}{\alpha(\sigma_0)}\right|$, $\oplus$ denotes the modulo shift function, and $\alpha(\ )$ is the predetermined scaling function.

27. (original): A computer-readable recording medium for storing program codes for performing a digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining m x n filtered images with respect to the two arbitrary images using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and

(b) calculating the matching metric defined by:

$$d_{m,n}(i,j)=\min_{l\le t\le K}\left[\sum_{m,n}\left(\left|\frac{\mu_{m,n}^{(i)}}{\alpha(\mu_{m,n})}-\frac{\mu_{m,n\oplus t}^{(j)}}{\alpha(\mu_{m,n})}\right|\right)+\left(\left|\frac{\sigma_{m,n}^{(i)}}{\alpha(\sigma_{m,n})}-\frac{\sigma_{m,n\oplus t}^{(j)}}{\alpha(\sigma_{m,n})}\right|\right)\right]$$

with respect to the m x n filtered images, where a mean and a variance of the pixel values of the respective images are μ and σ, K is a predetermined positive integer representing a number of

orientations to be considered, $\oplus$ denotes a modulo shift function, and α( ) is a predetermined scaling function.

28. (original): The computer-readable recording medium according to claim 27, wherein the step of (b') calculating the matching metric further defined by:

$$d_{m,n}(i,j) = \min_{l \le l \le K}\left[\sum_{m,n}\left(\left|\frac{\mu^{(i)}_{m,n}}{\alpha(\mu_{m,n})} - \frac{\mu^{(j)}_{m,n\oplus l}}{\alpha(\mu_{m,n})}\right|\right) + \left(\left|\frac{\sigma^{(i)}_{m,n}}{\alpha(\sigma_{m,n})} - \frac{\sigma^{(j)}_{m,n\oplus l}}{\alpha(\sigma_{m,n})}\right|\right)\right] + b$$

with respect to the m x n filtered images, where the mean and the variance of the pixel values of the respective images are μ and σ, a mean and a variance of pixel values of the original image are and μ_0 and σ_0, K is the predetermined positive integer representing the number of orientations to be considered, $\oplus$ denotes the modulo shift function, and α( ) is the predetermined scaling function.

29. (original): A digital image texture analyzing apparatus for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary digital images, the apparatus comprising:

a filtering unit which obtains m x n filtered images with respect to the two arbitrary images by filtering an original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and

a matching metric calculating unit which calculates the matching metric defined by:

$$d_{m,n}(i,j) = \min_{l \le l \le K}\left[\sum_{m,n}\left(\left|\frac{\mu^{(i)}_{m,n}}{\alpha(\mu_{m,n})} - \frac{\mu^{(j)}_{m,n\oplus l}}{\alpha(\mu_{m,n})}\right|\right) + \left(\left|\frac{\sigma^{(i)}_{m,n}}{\alpha(\sigma_{m,n})} - \frac{\sigma^{(j)}_{m,n\oplus l}}{\alpha(\sigma_{m,n})}\right|\right)\right] + b$$

with respect to the m x n filtered images, where a mean and a variance of pixel values of the respective filtered images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0, K is a predetermined positive integer representing the number of orientations to be considered, $\oplus$ denotes the modulo shift function, and $\alpha(\,)$ is the predetermined scaling function.

30. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining filtered images using predetermined filters having different scale coefficients with respect to the two arbitrary images; and

(b) obtaining a matching metric by calculating a minimum value of a sum of absolute differences between means of pixel values with respect to an arbitrary filtered image and images filtered by filters having scale coefficients different from those of filters used for filtering the arbitrary image.

31. (previously presented): The method according to claim 30, wherein the predetermined filters are Gabor filters.

32. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining filtered images using predetermined filters having different scale coefficients with respect to the two arbitrary images; and

(b) obtaining a matching metric by calculating a minimum value of a sum of absolute differences between variances of pixel values with respect to an arbitrary filtered image and images filtered by filters having scale coefficients different from those of filters used for filtering the arbitrary image.

33. (previously presented): The method according to claim 32, wherein the predetermined filters are Gabor filters.

34. (original): The method according to claim 32, wherein the step (b) includes the step of (b') obtaining a matching metric by calculating the minimum value of an added value of the sums of absolute differences between the means and a variance of the pixel values with respect to an arbitrary filtered image and images filtered by filters having scale filters different from those of filters used for filtering the arbitrary image.

35. (original): The method according to claim 32, wherein the step (a) includes the step of (a') obtaining m x n filtered images with respect to the two arbitrary images by filtering an original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and wherein the step (b) includes the step of (b') calculating the matching metric defined by:

$$d(i,j) = \min_{\substack{p=0,1\\ q=0,1}} \left[\sum_{m}^{S-1} \sum_{n} \left| \frac{\mu^{i}_{m+p,n}}{\alpha(\mu_{m+p,n})} - \frac{\mu^{j}_{m+q,n}}{\alpha(\mu_{m+q,n})} \right| + \left| \frac{\sigma^{i}_{m+p,n}}{\alpha(\sigma_{m+p,n})} - \frac{\sigma^{j}_{m+q,n}}{\alpha(\sigma_{m+q,n})} \right| \right]$$

with respect to the original image and the m x n filtered images, where a mean and a variance of pixel values of the respective images are μ and σ, S is a predetermined positive integer representing a number of scale coefficients to be considered, and $\alpha(\ )$ is a predetermined scaling function.

36. (original): The method according to claim 35, wherein the step (b') includes the step of calculating the matching metric defined by:

$$d(i,j)=\min_{\substack{p=0,1\\q=0,1}}\left[\sum_{m}^{S-1}\sum_{n}\left|\frac{\mu^{i}_{m+p,n}}{\alpha(\mu_{m+p,n})}-\frac{\mu^{j}_{m+q,n}}{\alpha(\mu_{m+q,n})}\right|+\left|\frac{\sigma^{i}_{m+p,n}}{\alpha(\sigma_{m+p,n})}-\frac{\sigma^{j}_{m+q,n}}{\alpha(\sigma_{m+q,n})}\right|\right]+b$$

with respect to the original image and the m x n filtered images, where the mean and the variance of the pixel values of the respective images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0, $b=\left|\frac{\mu_0^{(i)}-\mu_0^{(j)}}{\alpha(\mu_0)}\right|+\left|\frac{\sigma_0^{(i)}-\sigma_0^{(j)}}{\alpha(\sigma_0)}\right|$, S is the predetermined positive integer representing the number of scale coefficients to be considered, and $\alpha(\,)$ is the predetermined scaling function.

37. (original): A computer-readable recording medium for storing program codes for performing a digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining m x n filtered images with respect to the two arbitrary images by filtering an original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and

(b) calculating the matching metric defined by:

$$d(i,j)=\min_{\substack{p=0,1\\q=0,1}}\left[\sum_{m}^{S-1}\sum_{n}\left|\frac{\mu^{i}_{m+p,n}}{\alpha(\mu_{m+p,n})}-\frac{\mu^{j}_{m+q,n}}{\alpha(\mu_{m+q,n})}\right|+\left|\frac{\sigma^{i}_{m+p,n}}{\alpha(\sigma_{m+p,n})}-\frac{\sigma^{j}_{m+q,n}}{\alpha(\sigma_{m+q,n})}\right|\right]$$

with respect to the original image and the m x n filtered images, where a mean and a variance of pixel values of the respective images are μ and σ, S is a predetermined positive integer

representing a number of scale coefficients to be considered, and α( ) is a predetermined scaling function.

38. (original): The computer-readable recording medium according to claim 37, wherein the step (b) includes the step of calculating the matching metric defined by:

$$d(i,j)=\min_{\substack{p=0,1\\q=0,1}}\left[\sum_{m}^{S-1}\sum_{n}\left|\frac{\mu^{i}_{m+p,n}}{\alpha(\mu_{m+p,n})}-\frac{\mu^{j}_{m+q,n}}{\alpha(\mu_{m+q,n})}\right|+\left|\frac{\sigma^{i}_{m+p,n}}{\alpha(\sigma_{m+p,n})}-\frac{\sigma^{j}_{m+q,n}}{\alpha(\sigma_{m+q,n})}\right|\right]+b$$

with respect to the original image and the m x n filtered images, where the mean and the variance of the pixel values of the respective images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0, $b=\left|\frac{\mu_0^{(i)}-\mu_0^{(j)}}{\alpha(\mu_0)}\right|+\left|\frac{\sigma_0^{(i)}-\sigma_0^{(j)}}{\alpha(\sigma_0)}\right|$, S is the predetermined positive integer representing the number of scale coefficients to be considered, and α( ) is the predetermined scaling function.

39. (original): A digital image texture analyzing apparatus for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the apparatus comprising:

a filtering unit which obtains m x n filtered images with respect to the two arbitrary images by filtering an original image using predetermined filters, each having a unique combination of one of m scales and one of n orientations, where m and n are predetermined positive integers; and

a matching metric calculating unit which calculates the matching metric defined by:

$$d(i,j)=\min_{\substack{p=0,1\\q=0,1}}\left[\sum_{m}^{S-1}\sum_{n}\left|\frac{\mu^{i}_{m+p,n}}{\alpha(\mu_{m+p,n})}-\frac{\mu^{j}_{m+q,n}}{\alpha(\mu_{m+q,n})}\right|+\left|\frac{\sigma^{i}_{m+p,n}}{\alpha(\sigma_{m+p,n})}-\frac{\sigma^{j}_{m+q,n}}{\alpha(\sigma_{m+q,n})}\right|\right]$$

with respect to the original image and the m x n filtered images, where a mean and a variance of pixel values of the respective images are μ and σ, S is a predetermined positive integer representing a number of scale coefficients to be considered, and $\alpha(\,)$ is a predetermined scaling function.

40. (previously presented): The apparatus according to claim 39, wherein the predetermined filters are Gabor filters.

41. (original): The apparatus according to claim 39, wherein the matching metric calculating unit calculates the matching metric defined by:

$$d(i,j) = \min_{\substack{p=0,1\\ q=0,1}} \left[\sum_{m}^{S-1} \sum_{n} \left| \frac{\mu^{i}_{m+p,n}}{\alpha(\mu_{m+p,n})} - \frac{\mu^{j}_{m+q,n}}{\alpha(\mu_{m+q,n})} \right| + \left| \frac{\sigma^{i}_{m+p,n}}{\alpha(\sigma_{m+p,n})} - \frac{\sigma^{j}_{m+q,n}}{\alpha(\sigma_{m+q,n})} \right| \right] + b$$

with respect to the original image and the m x n filtered images, where the mean and the variance of the pixel values of the respective images are μ and σ, a mean and a variance of pixel values of the original image are μ_0 and σ_0, $b = \left| \frac{\mu_0^{(i)} - \mu_0^{(j)}}{\alpha(\mu_0)} \right| + \left| \frac{\sigma_0^{(i)} - \sigma_0^{(j)}}{\alpha(\sigma_0)} \right|$, S is the predetermined positive integer representing the number of scale coefficients to be considered, and $\alpha(\,)$ is the predetermined scaling function.

42. (original): A digital image texture analyzing method for evaluating a similarity of textures of two arbitrary digital images by obtaining a matching metric between the two arbitrary images, the method comprising the steps of:

(a) obtaining filtered images using predetermined filters having different orientation and scale coefficients with respect to the two arbitrary images; and

(b) obtaining a matching metric by calculating a minimum value of a sum of absolute differences between variances and means of pixel values with respect to an arbitrary filtered image and images filtered by filters having scale and orientation coefficients different from those of filters used for filtering the arbitrary image.